# Regional Land-Atmosphere-Cloud Analysis and Prediction System (ReLAPS): Application to CLAMS *(Realtime ReLAPS for CLAMS)*

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*We are planning to run realtime numerical weather forecast for CLAMS, here is a brief introduction to the forecast system.*

## 1, About ReLAPS: *under developing…*

Based on the Advanced Regional Prediction System (ARPS) developed by The University of Oklahoma.

▲ ***Components:***

Atmosphere/Cloud forecast model: 3-D nonhydrostatic compressible explicit microphysical forecast model. 3-D original dynamic equations (u,v,w,p,t,qv); Explicit cloud/precipitate forecasting (qc,qi,qr,qs,qh); Cloud-radiation interaction scheme.

Coupled land surface model (LSM): 2-layer vegetation-land-soil model, 1-km resolution USDA surface characteristics database.

Data analysis and assimilation system: besides the conventional surface and sounding data, also can handle the profiler, satellite, radar and aircraft observations

A post-analysis and plot package

▲ ***Applications:***

a) High-resolution Data Analysis and Assimilation
b) Numerical Weather Prediction
c) Cloud-Radiation Interactions
d) Regional Climate Research and Prediction
e) Regional Land-Atmosphere Interactions
f) Cloud-scale to Meso-scale Convections in the Climate System
g) Local/Regional Pollution Transport
h) …

▲ ***Observation data sources for forecast and analysis:***

■ NCEP/Eta model: Used for boundary conditions and as a first guess for initial conditions.
■ Rawinsonde: Used on forecasts and grid analyses only.
■ Wind Profiler: All grids.
■ METAR (surface observations): All grids.
■ Satellite: IR/Vis used in cloud analysis.
■ NIDS (coarsely discretized radar data) and NEXRAD level II data: Reflectivity used in cloud analysis.

## 2, ReLAPS Products: in high spatial and temporal resolution

Land/Surface: skin/soil temperature and moisture; precipitation, surface fluxes (latent/sensible heat)

Atmosphere: 3-D meteorological fields (u,v,w,p,t,qv)

Cloud: 3-D cloud and precipitate fields (qc,qi,qr,qs,qh); and cloud properties

Radiation: surface/TOA radiation fluxes; radiation forcing

## 3, Real-time ReLAPS for CLAMS: A Proposing Plan…

- Provide the site local/regional numerical weather forecast
- Provide more accurate 3-D meteorological/cloud fields
- Validate ReLAPS using CLAMS observed/retrieval data

▲ *Forecast domain:* **Mid-Atlantic Region** @ 15-km resolution, 83x83x43 grid points; Twice daily 24 hours forecasts starting at 00Z and 12Z (see figs)

▲ *Analysis/Assimilation domain:* **West-Atlantic Region** @ 15-km resolution, 153x153x43 grid points; 6-hourly analysis at 00Z, 06Z, 12Z, 18Z for each day (see figs)

▲ *Local Lighthouse domain:* With higher resolution @ 2-5 km if need?

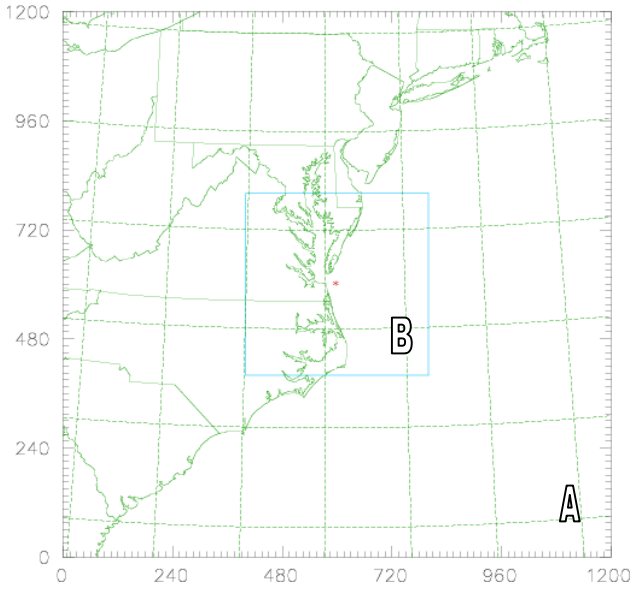
▲ *A sample case:* 24 hours forecast over the Mid-Atlantic Region with 15-km resolution start at 12Z 30 Jan. 2001. It takes about 5.5 hours on 8-processor Origin2000.

A list of product plots: (just show some figs)

Surface atmospheric/cloud variables;
Surface skin/soil temperature and moisture;
X-Z cross sections through Lighthouse;
Lighthouse sounding and profiles;
Lighthouse surface meteograms (time series);
Surface fluxes.

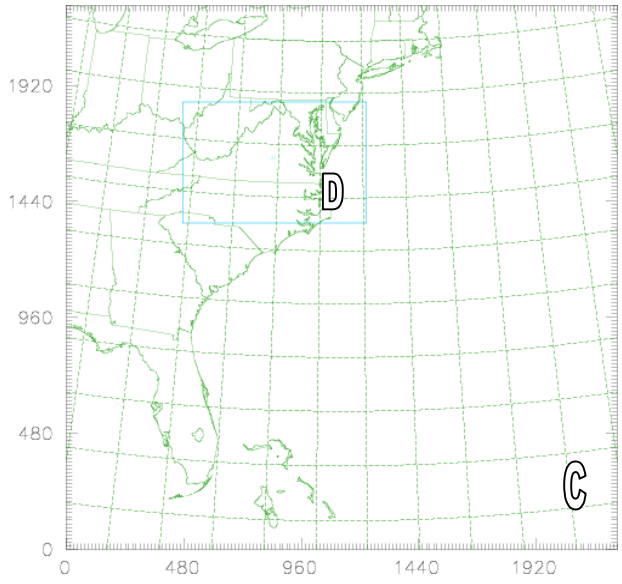
## Forecast Nested Domains

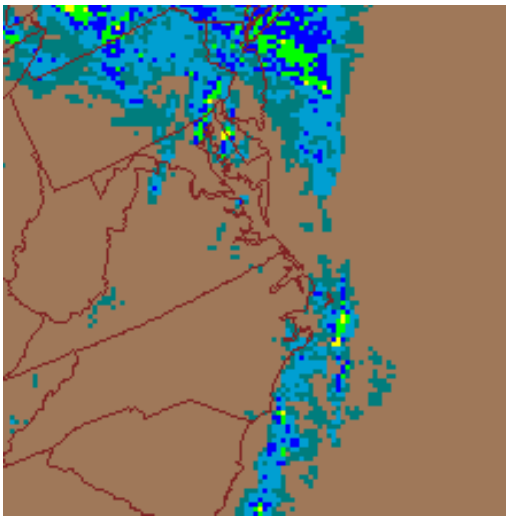
A: Mid-Atlantic Region: 1200km x 1200km @dx=15km
B: Lighthouse Local Area: 400kmx400km @dx=5km



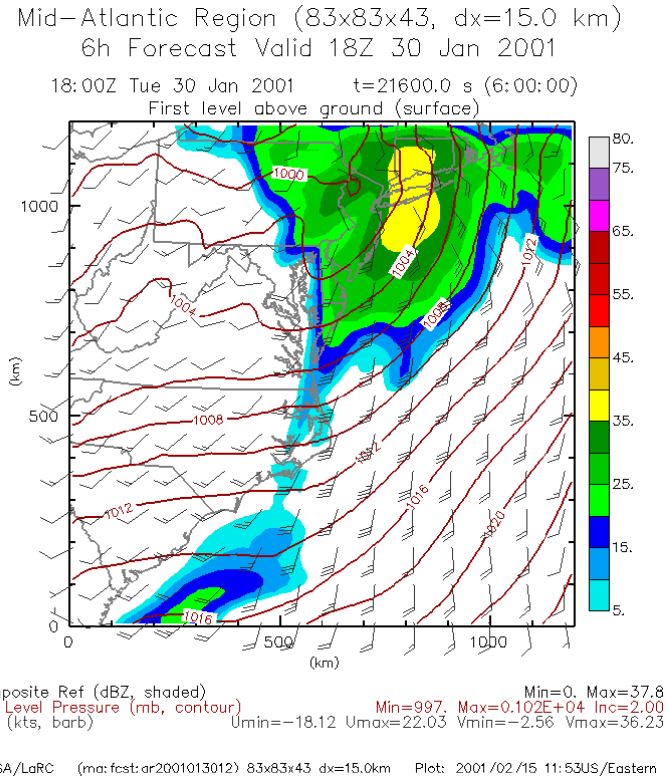

## Analysis/Assimilation Domains

C: West-Atlantic Region: 2250kmx2250km@dx=15km
D: Local Area: 750kmx750km @dx=5km

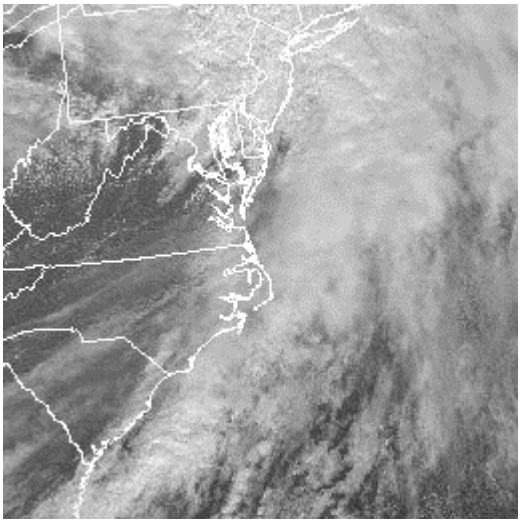




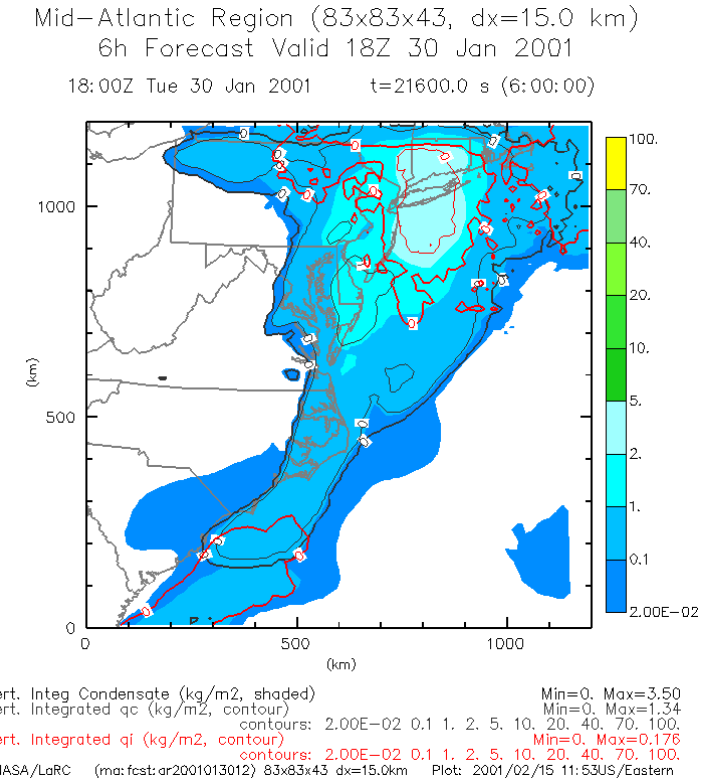
Radar Observed Reflectivity at 18Z



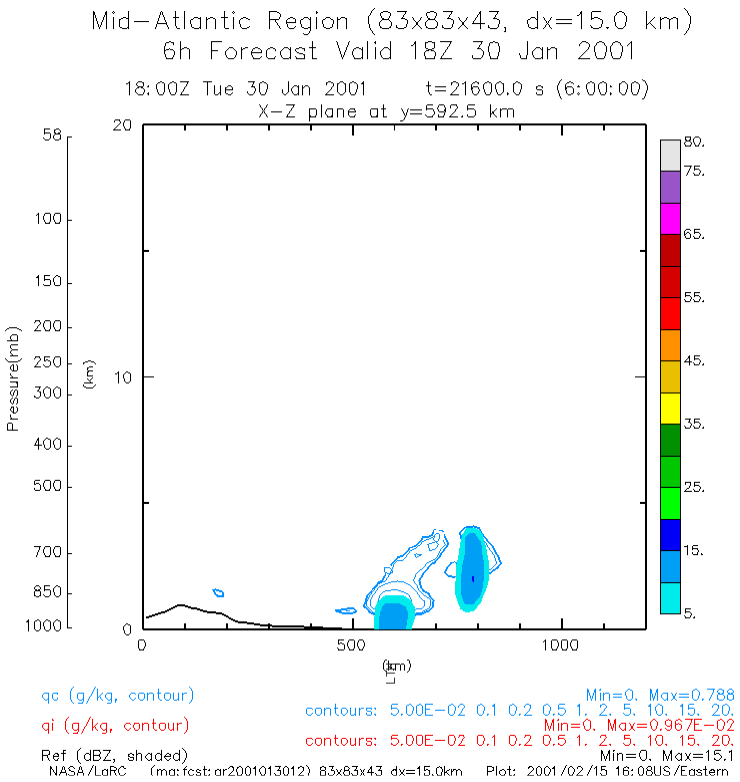

Model 6hrs Forecast Valid at 18Z



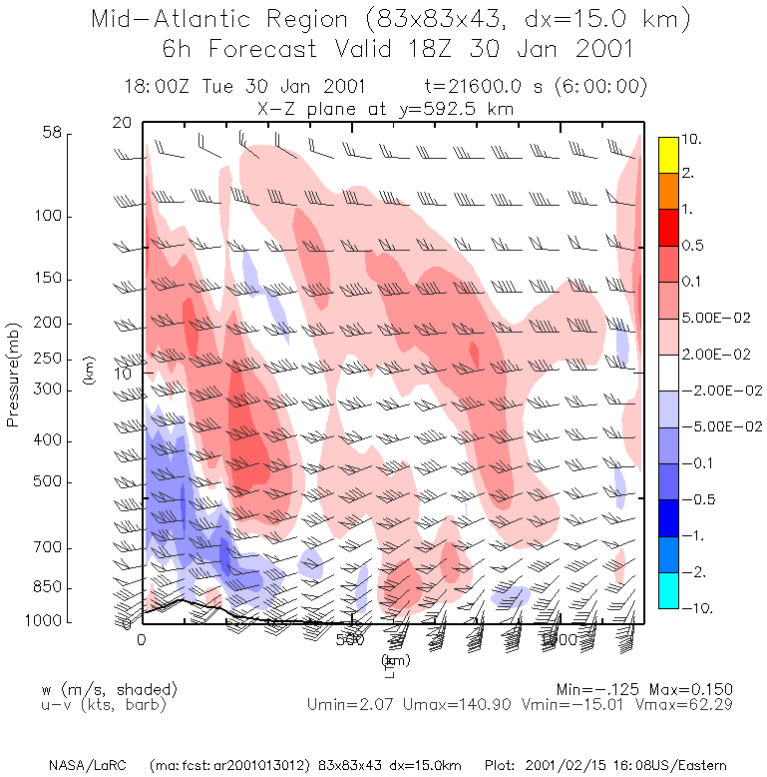
GOES Visible Image at 18Z



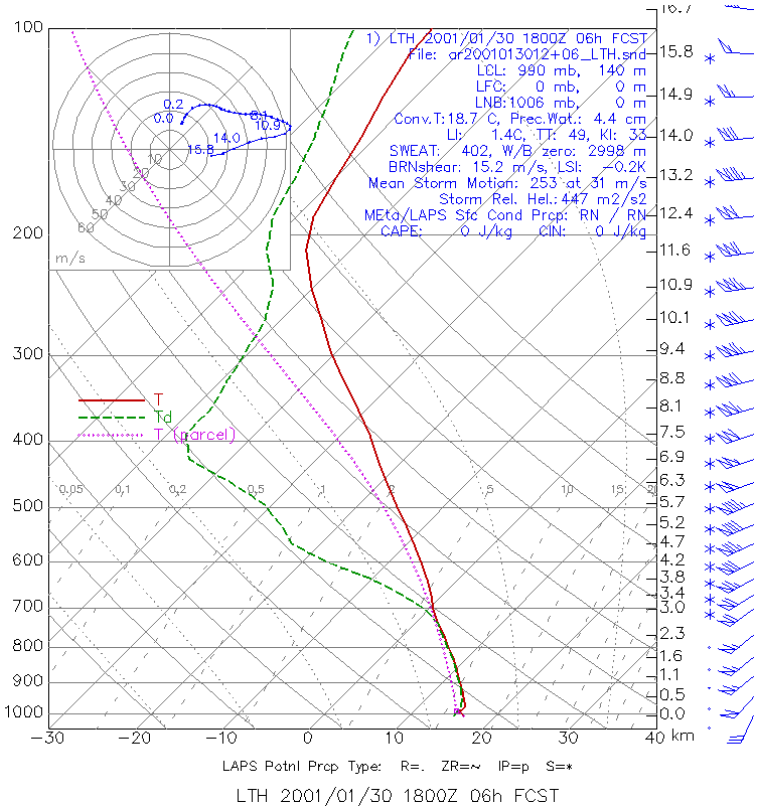

Model 6hrs Forecast Total Condensate Path Valid at 18Z



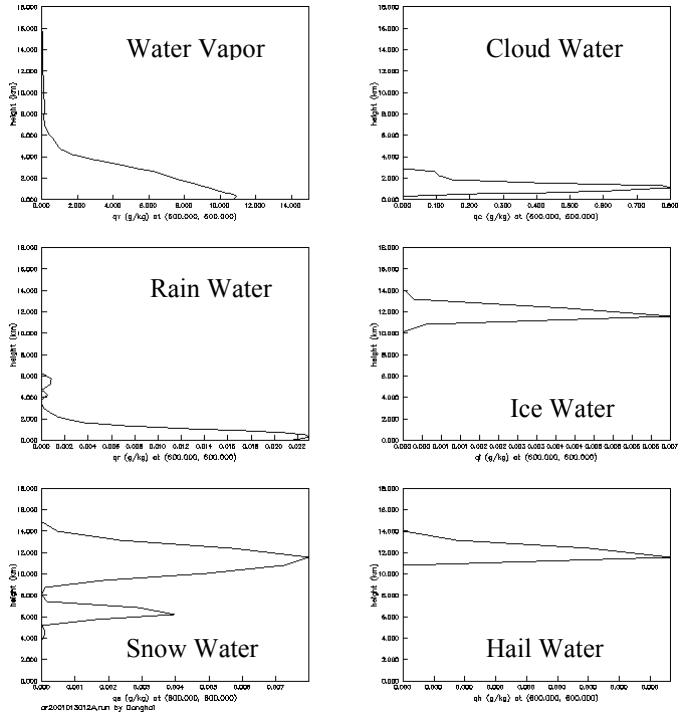

West-East Cross Section Through Lighthouse: Clouds and Reflectivity Fields




West-East Cross Section Through Lighthouse: Vertical Velocity and Horizontal Wind




Model 6hrs Forecast Sounding for Lighthouse




Model 6hrs Forecast Cloud Profiles for Lighthouse